Precise Examination of the Field-Induced Phases of HMTSF-TCNQ

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Introduction

The quasi-1D organic conductor was shown by the present authors to exhibit field-induced (FI) phases at the pressure of 1 GPa where ambient pressure charge density wave (CDW) was suppressed [1-3]. It is of interest to examine whether the FI-phases are of CDW- or SDW- origin, and to what extent they are similar to or different from the FISDW in $(TMTSF)_2X$-salts.

We have already worked with this salt a few times in NHMFL. But the work of this time was strongly motivated since there was a drastic improvement of the sample quality, which used to be very difficult to refine. All the crystals at this experiment were selected by X-ray examination, and were confirmed to be ideal single crystals with their sharp Bragg spots.

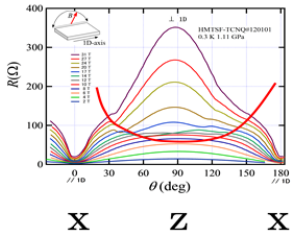

Fig. 1 Angular dependence of magnetoresistance in *x-z* plane at 0.4 K and 1.11 GPa.

Experimental

We studied angular dependence of magnetoresistance (AMRO) at various magnetic fields rotating a miniature pressure cells and temperatures using 31 T magnet at cell 9 with rotatable miniature pressure cell, and 45 T magnet. The AMRO was carried out with 3 independent rotations using 2 pressure cells.

Results and Discussion

Figure 1 shows a typical AMRO showing the field and angle regions of FI-phases, the border of which is drawn by a red line. Fixing the orientation of magnetic field, magnetoresistance shows hysteretic behavior at the transition fields, which are very much dependent on the angle as shown in Fig. 2 (top). By plotting the transition fields with respect to angle, it became clear that the FI-phases were observed at all angles and continuously in the *y-z* plane as seen in Fig. 2 (bottom), where hysteresis regions are shown with bars. This is the first time in the series of high field experiment with HMTSF-TCNQ.

Figure 3 shows a magnetoresistance observed with B//~*y* axis at temperature of 2 K. The FI-phase is also seen by the magnetoresistance hysteresis. Also shown is the apparent temperature variation during the field sweep up and down. Although the real temperature was not known due the magnetoresistance of Cernox, there was no discontinuous temperature drift during the sweep up and down, which is shown by the temperature(of Cernox)-curves in Fig. 3 as well, the existence of FI-phase is clear.

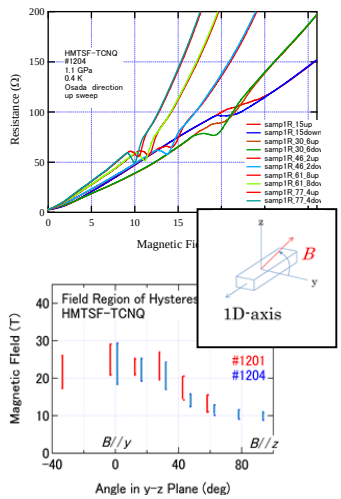

Fig. 2 Magnetoresistance (top) and the transition fields vs angle (bottom) in the *y-z* plane at 0.4 K and 1.11 GPa.

Conclusions

Using rotatable system and miniature pressure cells, we could obtain the structure of FI-phases of HMTSF-TCNQ to a large extent at the critical pressure where ambient CDW is suppressed.

Acknowledgements

This work is partially supporte by IMR Tohoku Univ., JSPS Inst. Prog. for Young Researcher Overseas Visits "Promoting Internat'l Young Researchers in Mathematics and Math. Sci. by OCAMI", and Grant-in-Aid Sci. Res. on Innovative Areas #23110722 from M. Education, and NSF DMR#1005293(FSU). Work at the NHMFL is supported by the NSF DMR#0654118, and by the State of Florida.

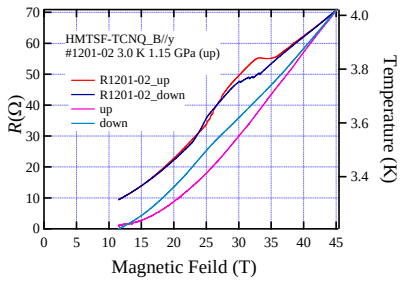

Fig. 3 Transition is seen beyond 35 T//~*y* at 2 K. Bottom curves show the Cernox apparent temperature in field with right-hand axis, showing temperature drift is continuous even if any.

References

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